

# PROJECT facts

U.S. DEPARTMENT OF ENERGY  
OFFICE OF FOSSIL ENERGY  
NATIONAL ENERGY TECHNOLOGY LABORATORY

Combustion  
Technologies

04/2004



## CATALYTIC UNMIXED COMBUSTION OF COAL WITH ZERO POLLUTION

### Description

Unmixed combustion (UMC) is a GE-proprietary technology that appears to offer superior performance with respect to thermodynamic efficiency and low pollutant emissions. The process converts pulverized coal into separate streams of sequestration-ready  $\text{CO}_2$  (including other pollutants such as  $\text{SO}_2$ ,  $\text{NO}_x$ , and Hg) and a clean hot gas stream for turbines. This approach significantly reduces pollution control costs by reducing the volume of gas that must be cleaned. In addition,  $\text{NO}_x$  formation due to nitrogen from the air is considerably minimized. The entire process is conducted at elevated pressure, which permits the heat generated by catalyst regeneration to be used in a combined cycle for electricity production and shaft work. Also, the elevated pressure reduces the cost of subsequent  $\text{CO}_2$  treatment prior to sequestration. For power generation with gas turbine and steam turbine, preliminary ASPEN Plus simulation suggests that the UMC-Coal concept including  $\text{CO}_2$  separation can have a net process efficiency of 43% of coal high heating value (HHV).

### CONTACT POINTS

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### PROJECT COST

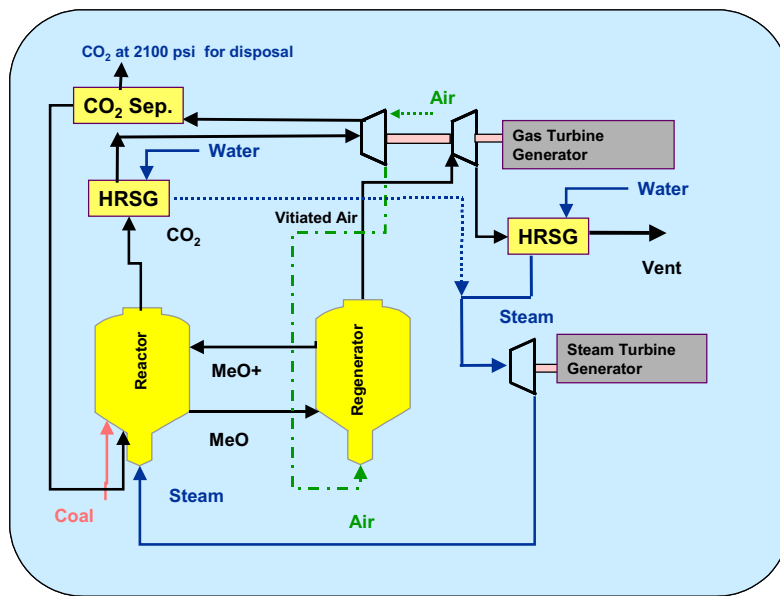
\$845,425

### PROJECT DURATION

10/01/03 - 9/30/05

### WEBSITE

www.netl.doe.gov

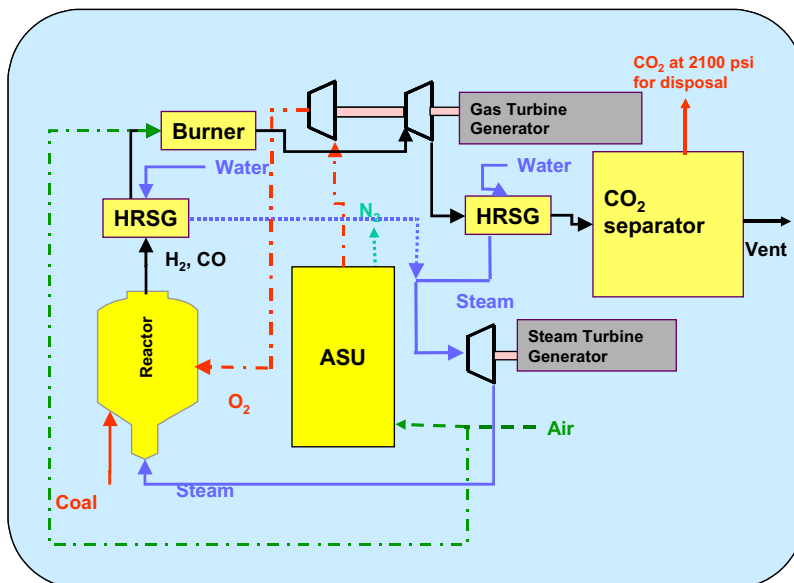


*UMC Process Integrated with a Combined-Cycle Plant*

## PARTNERS

**GE Global Research**  
Irvine, CA

**Southern Illinois University**  
Carbondale, IL

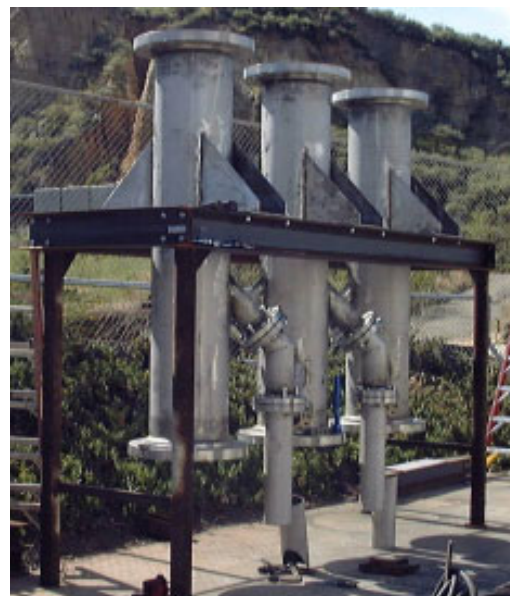


*Process Flow Diagram for a Typical IGCC Process with CO<sub>2</sub> Separation*

## Goals

The goals of this project are as follows:

- Demonstrate in a two-reactor pilot-scale system the unmixed combustion (UMC) of coal with metal oxide catalysts;
- Conduct lab- and pilot-scale tests;
- Perform engineering and economic analyses; and
- Prepare a full-scale conceptual design of the UMC process.



*Three-reactor pilot unit will be reconfigured to a two-reactor system.*

## Accomplishments

As of April 2004, the global process analysis has been completed. The ASPEN Plus simulation suggests an overall process efficiency of 43% of coal HHV, which is about 9% higher than other advanced technologies now being developed to include CO<sub>2</sub> separation.